

Multiplying and Dividing Integers

Some Notes on Notation

You have been writing integers with raised signs to avoid confusion with the symbols for addition and subtraction. However, most computer software and most writing in mathematics do not use raised signs.

Positive numbers are usually written without a sign.

$$+3 = 3 \text{ and } +7.5 = 7.5$$

Negative numbers are usually written with a dash like a subtraction sign.

$$^-3 = -3 \text{ and } ^-7.5 = -7.5$$

From now on, we will use this notation to indicate a negative number.

This can be confusing if you don't read carefully. Parentheses can help.

$$^-5 - ^-8 = -5 - -8 = -5 - (-8)$$

The subtraction symbol also indicates the opposite of a number. For example, -8 represents the opposite of 8. The expression $-(-8)$ represents the opposite of -8 .

$$-(-8) = 8$$

For multiplication, you can use a raised dot symbol.

$$3 \times 5 = 3 \cdot 5$$

In this investigation, you will use time, distance, speed, and direction to think about multiplication and division of integers. You will also look at number patterns and develop algorithms for multiplying and dividing these numbers.

Did You Know?

Michael Johnson set a world record by running 400 meters in 43.18 seconds at the world track championships in 1999. Florence Griffith Joyner set an Olympic record when she ran 100 meters in 10.62 seconds in 1988.

How long would it take each runner to run 1,000 meters at his or her record speed?



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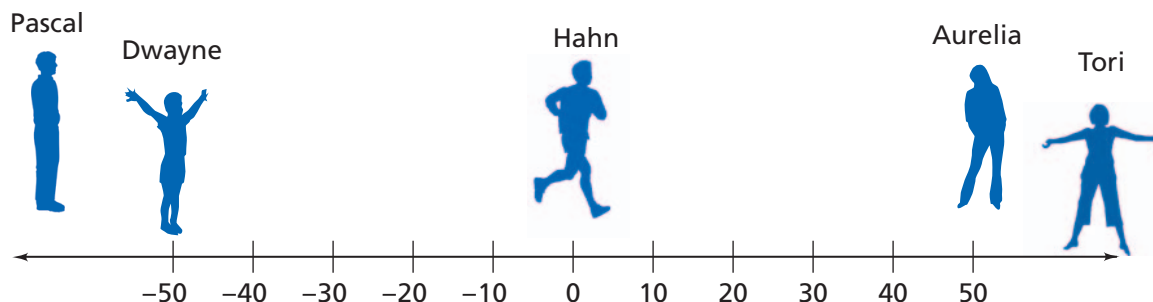
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3.1

Introducing Multiplication of Integers

The math department at Everett Middle School sponsors a contest called the Number Relay. A number line measured in meters is drawn on the school field. Each team has five runners. Runners 1, 3, and 5 stand at the -50 meter line. Runners 2 and 4 stand at the 50 meter line.

Team 1



For Team 1:

- Hahn starts and runs from -50 to 50 . He tags Aurelia.
- Aurelia runs back from 50 to -50 . She tags Dwayne.
- Dwayne runs from -50 to 50 . He tags Tori.
- Tori runs from 50 to -50 . She tags Pascal.
- Pascal runs from -50 to the finish line at position 0 .

The team whose final runner reaches the 0 point first wins.

Problem 3.1 Introducing Multiplication of Integers

A. Write number sentences that express your answers to these questions. Use positive numbers for running speeds to the right and negative numbers for running speeds to the left. Use positive numbers for time in the future and negative numbers for time in the past. Each runner runs at a constant speed.

1. Hahn passes the 0 point running 5 meters per second to the right. Where is he 10 seconds later?
2. Dwayne passes the 0 point running 4 meters per second to the right. Where is he 5 seconds later?
3. Aurelia passes the 0 point running to the left at 6 meters per second. Where is she 8 seconds later?
4. Pascal passes the 0 point running to the right at 3 meters per second. Where was he 6 seconds earlier?
5. Tori passes the 0 point running to the left at 5 meters per second. Where was she 7 seconds earlier?

B. 1. Find the products in each group below.

Group 1	Group 2	Group 3
4×3	$4 \times (-3)$	$-4 \times (-3)$
5.1×1	-1.5×2	$-7 \times (-4)$
3×4.5	$10 \times (-11)$	$-5.2 \times (-1)$

2. Describe what the examples in each group have in common.
3. Use your answer to part (2) to write two problems for each group.
4. Describe an algorithm for multiplying rational numbers.
5. Use your strategy to multiply these rational numbers.
 - a. $-1\frac{1}{2} \times \frac{3}{4}$
 - b. $-\frac{1}{2} \times (-\frac{3}{4})$
 - c. $2\frac{1}{2} \times (-\frac{3}{4})$
6. Is multiplication commutative? Does the order of factors matter? For example, are these multiplication sentences correct?

$$2 \cdot 3 \stackrel{?}{=} 3 \cdot 2$$

$$-2 \times (-3) \stackrel{?}{=} -3 \times (-2)$$

$$-2 \times 3 \stackrel{?}{=} 3 \times (-2)$$

ACE Homework starts on page 50.